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Krajicek et al.

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(54) **THERMAL VAPOR STREAM APPARATUS
AND METHOD**

(56) **References Cited**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 652 days.

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(57)

ABSTRACT

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F02C 7/12 (2006.01)

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(2013.01); **F02C 3/30** (2013.01); **F02C 7/12**
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See application file for complete search history.

A low-emission and environmentally-friendly apparatus and
method is used to generate a high-pressure stream of thermal
vapor. The thermal vapor stream may be injected into a sub-
surface petroleum-bearing formation for recovery of highly
viscous petroleum or used to turn a steam turbine for driving
an electrical generator. In one implementation, the high-pres-
sure stream of thermal vapor is generated by burning a high-
temperature fuel, including any short or long chain hydrocar-
bon products from methane to coal, in an enclosed vessel to
produce combustion gases. Various cooling techniques,
including regenerative cooling, may be employed to maintain
the internal temperature of the vessel below a predefined safe
level. The high-pressure thermal vapor stream may then be
used to enhance recovery of highly viscous petroleum.

6 Claims, 19 Drawing Sheets

